

PATENT
Atty. Dkt. No. APPM/004215.Y1/PPC/CMP/CKIM
Serial No.: 09/645,690

REMARKS

This is intended as a full and complete response to the Final Office Action dated December 8, 2005, having a shortened statutory period for response extended one month to expire on April 8, 2006. Please reconsider the claims pending in the application for reasons discussed below.

Claims 1-9, 11-18, 26-31 and 33 remain pending in the application and are shown above. Claims 1-9, 11-18, 26-31 and 33 stand rejected by the Examiner. Claims 2, 13, and 27 are cancelled without prejudice. Claims 1, 12, and 26 are amended to clarify the invention and include the limitations of claims 2, 13, and 27 without introducing new matter and claims 3, 5, 14, 16, and 33 are amended accordingly as to form. Applicant reserves the right to pursue the subject matter of the original claims 1-3, 5, 12-14, 16, 26-27 and claims dependent thereon at a later date. Reconsideration of the rejected claims is requested for reasons presented below.

Claim Rejections - 35 U.S.C. §103

Claims 1-9, 11-18, 26-31 and 33 stand rejected under 35 U.S.C. 103(a) as being obvious over *Small et al.* (US Patent No. 6,498,131) in view of *Prigge et al.* (US Patent 5,167,667), *Scrovan* (US Patent No. 5,645,682), *Talieh et al.* (US Patent No. 5,692,947), *Kennedy et al.* (US Patent No. 6,280,299) and *Sirchevski et al.* (US Patent No. 6,352,595). The Examiner states that *Small et al.* teaches a method of cleaning a CMP apparatus with a cleaning composition after CMP of wafers and *Small et al.* does NOT specifically teach the concentration for amines. The Examiner also states that *Small et al.* does NOT specifically teach the application of the composition to clean a polishing pad. The Examiner further states that *Prigge et al.*, *Scrovan*, *Talieh et al.*, *Kennedy et al.* and *Sirchevski et al.* disclose that CMP polishing pads are conventionally cleaned and at least *Prigge et al.*, *Scrovan*, and *Talieh et al.* teach removal of residue from the polishing pad in addition to cleaning. The Examiner asserts that it would have been obvious to an ordinary artisan at the time the invention was made to apply the cleaning solution of *Small et al.* for cleaning polishing pads with reasonable expectation of success in order to have the pad cleaned because *Small et al.* teaches the composition

PATENT
Atty. Dkt. No. APPM/004215.Y1/PPC/CMP/CKIM
Serial No.: 09/845,690

for cleaning CMP apparatuses and because *Prigge et al.*, *Scrovan*, *Talieh et al.*, *Kennedy et al.* and *Sirchevski et al.* teach that polishing pads are conventionally cleaned. Applicant respectfully traverses this rejection.

Small et al. discloses compositions and methods of cleaning a CMP equipment including interiors of various slurry delivery conduits. *Small et al.* discloses that the surface cleaning compositions are sprayed onto the various surfaces of the CMP apparatus when a user has completed polishing a number of semiconductor wafers or during changing or replacing a polishing pad, and the various surfaces of the CMP apparatus are wiped clean with a sponge or a polyurethane pad, which contains some amount of the cleaning composition. (See, column 8, lines 5-20.) *Small et al.* further discloses that, after the various surfaces of the CMP equipment are wiped with the cleaning composition-containing sponge, the various surfaces are thoroughly rinsed down, typically with de-ionized water. (See, column 8, lines 18-20.) In addition, *Small et al.* discloses that the cleaning compositions can be pumped through slurry distribution systems of the CMP apparatus to clean the interiors of various slurry delivery conduits in addition to pump distilled water through the slurry distribution systems to flush out the cleaning compositions. (See, column 8, lines 21-44.) *Small et al.* also discloses that the cleaning compositions can be useful for post-CMP cleaning of a wafer. (See, column 3, lines 1-2.) *Small et al.* does not teach, show, suggest, or motivate a method of cleaning a polishing pad surface including applying a cleaning composition to a polishing pad surface, as recited in claims 1, 12, 26, and claims dependent thereon.

In addition, *Small et al.* teaches three classes of cleaning compositions for surface cleaning a CMP equipment. A first class of the cleaning compositions of *Small et al.*, composition A, includes one or more non-ionic surfactants, one or more simple amines, a surfactant or sticking agent, such as one or more soluble dialcohol organic compounds, and one or more quaternary amines to a pH of about 10 to about 12.5. The first class of the cleaning compositions of *Small et al.* is very different from the claimed composition in that there is no acid selected from the group consisting of phosphoric acid, acetic acid and sulfuric acid, nor a base selected from the group consisting of potassium hydroxide, sodium hydroxide and ammonium hydroxide to adjust the pH of the composition. The first class of the cleaning compositions of *Small et al.* employs

PATENT
Atty. Dkt. No. APPM/004215.Y1/PPC/CMP/CKIM
Serial No.: 09/645,690

quaternary amines, such as tetramethylammonium hydroxide (TMAH), to adjust the pH of the compositions. (See, column 4, lines 64-67.) As disclosed in *Small et al.*, water, non-ionic surfactant, monoethanolamine (MEA), and propylene glycol are sequentially added together and the pH of the composition is measured by incrementally adding TMAH to obtain a final pH of above about 11 but below about 12. (See, column 5, lines 33-42.) A second class of the cleaning composition of *Small et al.*, composition B, includes a solution of one or more of citric acid, lactic acid, and oxalic acid, where TMAH or choline is added incrementally or step-wise to adjust the pH of the composition to a pH of about 8.5. A third class of the cleaning compositions of *Small et al.*, composition C, includes at least one oxidizing acid, at least one chelating agent, at least one sticking agent and at least one anionic surfactant to a pH of about 1.5 to 3.

Applicant has amended claims 1, 12, 26 and claims dependent thereon and submit that *Small et al.* does not teach, show, or suggest a cleaning composition, which is a solution including about 0.1 to about 3.0 wt.% of ethylenediamine, deionized water, and an acid selected from the group consisting of phosphoric acid, acetic acid and sulfuric acid or a base selected from the group consisting of potassium hydroxide, sodium hydroxide and ammonium hydroxide in an amount such that the composition has a pH of about 5.0 to about 12.0, as recited in amended claims 1, 12, 26, and claims dependent thereon. Accordingly, *Small et al.* does not teach, show, or suggest a method of cleaning a polishing pad surface subsequent to chemical-mechanical polishing (CMP) a wafer surface containing copper (Cu) or a Cu-based alloy by applying to the polishing pad surface a cleaning composition including about 0.1 to about 3.0 wt.% of ethylenediamine, deionized water, and an acid selected from the group consisting of phosphoric acid, acetic acid and sulfuric acid or a base selected from the group consisting of potassium hydroxide, sodium hydroxide and ammonium hydroxide in an amount such that the composition has a pH of about 5.0 to about 12.0, as recited in claims 1, 12, 26, and claims dependent thereon.

Prigge et al. teaches a method of treating a polishing cloth containing residues thereon by providing transversely across the polishing cloth a base plate with two slots openings for a treatment liquid to flow through the polishing cloth, remove residues from the polishing cloth, and flow into the end of the base plate. *Prigge et al.* further discloses

that the treatment liquid is an alkali hydroxide or alkali carbonate solution. *Prigge et al.* does not teach, show, or suggest the composition as claimed in claims 1, 12, 26, and claims dependent thereon for cleaning a polishing pad.

Scrovan teaches a method of conditioning a polishing pad with a conditioning solution at the same time a wafer is being polished with a polishing solution. *Scrovan* also discloses that the conditioning solution for a polishing pad during a CMP process can be an ammonium hydroxide or a potassium hydroxide solution. *Prigge et al.* does not teach, show, or suggest the composition as claimed in claims 1, 12, 26, and claims dependent thereon for cleaning a polishing pad.

Talieh et al. teaches a CMP apparatus 10 which includes a pad conditioning station 66 for conditioning a polishing member/pad 14 during polishing of a wafer, where the pad conditioning station includes a scarping member 70, such as a diamond conditioning block, to roughen the surface of the polishing member 14 prior to passing the polishing member 14 to an acid bath 72, a rinse bath 74, and a slurry bath 76. (See, column 6, lines 50-67, column 7, lines 1-3.) The acid bath 72 contains a diluted hydrofluoric acid solution. (See, column 7, lines 3-6.) *Talieh et al.* does not teach, show, or suggest a cleaning composition as claimed in claims 1, 12, 26, and claims dependent thereon for cleaning a polishing pad.

Kennedy et al. discloses methods and apparatus of cleaning and rinsing a polishing pad surface or a substrate surface using a fluid delivery system 20 including a fluid delivery arm 24 for dispensing a slurry or a rinsing agent. *Kennedy et al.* does not teach, show, or suggest the composition as claimed in claims 1, 12, 26, and claims dependent thereon. And there is no motivation existed in the combination of references to combine the surface cleaning compositions of *Small et al.* with the polishing pad cleaning method of *Kennedy et al.*

Svirchevski et al. discloses a method of cleaning a polishing pad using a composition of hydrogen chloride (HCl) and water when the wafer surface is copper. *Svirchevski et al.* also discloses a cleaning composition of ammonium hydroxide (NH₄OH) and water, when the wafer surface is oxide. *Svirchevski et al.* does not teach, show, or suggest the composition as claimed in claims 1, 12, 26, and claims dependent thereon. And there is no motivation existed in the combination of references to combine

the surface cleaning compositions of *Small et al.* with the polishing pad cleaning method of *Svirchevski et al.*

Further, Applicant asserts that the Examiner has not supplied the requisite motivation from the combination of references to combine the teachings of *Small et al.*, which discloses cleaning compositions and a method of cleaning various surfaces of a CMP equipment with a cleaning composition using a sponge when the CMP equipment is not in use to polish a wafer or during changing or replacing a polishing pad, with the teachings of *Prigge et al.*, *Scrovan*, *Talieh et al.*, *Kennedy et al.* and *Sirchevski et al.*, which disclose a method of conditioning a polishing pad during CMP or cleaning a polishing pad after CMP with various compositions. Applicant submits that "[t]he showing of a motivation to combine must be clear and particular, and it must be supported by actual evidence. *In re Dembiczak*, 50 U.S.P.Q. 2d 1614, 1617 (Fed. Cir. 1999).

The Examiner has failed to show a clear and particular motivation by the skilled artisan to select from the combined disclosures of *Small et al.* with *Prigge et al.*, *Scrovan*, *Talieh et al.*, *Kennedy et al.* and *Sirchevski et al.* On this point, the Federal Circuit has ruled that "[o]ne cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention." (*In re Fritch* at 1784). In order to avoid using the Applicant's disclosure as a blueprint to pick and choose certain elements, while ignoring others, the Examiner must supply a clear and particular motivation or suggestion to do so. In the present case, the only suggestion is provided in the Applicant's disclosure and thus hindsight.

Furthermore, the compositions, methods or steps of *Small et al.*, *Prigge et al.*, *Scrovan*, *Talieh et al.*, *Kennedy et al.* and *Sirchevski et al.* are each distinctly described and, in combination, provide no suggestion, motivation, or expectation of success for the claimed subject matter. The combination of *Small et al.* in view of *Prigge et al.*, *Scrovan*, *Talieh et al.*, *Kennedy et al.* and *Sirchevski et al.* does not teach, show, or suggest the claimed composition including about 0.1 to about 3.0 wt.% ethylenediamine, deionized water, and an acid selected from the group consisting of phosphoric acid, acetic acid and sulfuric acid or a base selected from the group consisting of potassium hydroxide, sodium hydroxide and ammonium hydroxide in an amount such that the

composition has a pH of about 5.0 to about 12.0, nor applying the claimed composition to a polishing pad surface. The Examiner has yet to show such a suggestion.

The burden for establishing a prima facie case of obviousness falls on the Examiner. See, MPEP §2142. A basic requirement of establishing a prima facie case of obviousness is that the combination of prior art references must teach or suggest all the claim limitations and that there must be a motivation to combine the teaching of the references. See, MPEP §2143. The Applicants assert that the Examiner has failed to establish a prima facie case because *Small et al.* in view of *Prigge et al.*, *Scrovan*, *Talieh et al.*, *Kennedy et al.* and *Sirchevski et al.*, alone or in combination, does not disclose, suggest, or motivate a method of cleaning a polishing pad surface subsequent to chemical-mechanical polishing (CMP) a wafer surface containing copper (Cu) or a Cu-based alloy by applying to the polishing pad surface a cleaning composition including about 0.1 to about 3.0 wt.% ethylenediamine, an acid selected from the group consisting of phosphoric acid, acetic acid and sulfuric acid or a base selected from the group consisting of potassium hydroxide, sodium hydroxide and ammonium hydroxide in an amount such that the composition has a pH of about 5.0 to about 12.0, and deionized water, as recited in claim 1 and claims dependent thereon.

Small et al. in view of *Prigge et al.*, *Scrovan*, *Talieh et al.*, *Kennedy et al.* and *Sirchevski et al.*, alone or in combination, does not disclose, suggest, or motivate a method which includes conducting chemical-mechanical polishing (CMP) on a first wafer surface of a first wafer containing copper (Cu) or a Cu-based alloy on a surface of a polishing pad, removing the first wafer from the pad, applying to the polishing pad surface a cleaning composition including about 0.1 to about 3.0 wt.% of ethylenediamine, an acid selected from the group consisting of phosphoric acid, acetic acid and sulfuric acid or a base selected from the group consisting of potassium hydroxide, sodium hydroxide and ammonium hydroxide in an amount such that the composition has a pH of about 5.0 to about 12.0, and deionized water, rinsing the polishing pad surface with water to remove any cleaning composition on the polishing surface, conducting CMP on a second wafer, and then repeating the removing step through the conducting CMP step, as recited in claim 12 and claims dependent thereon.

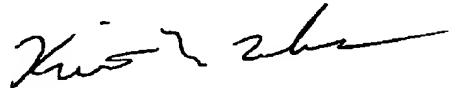
PATENT
Atty. Dkt. No. APPW004215.Y1/PPC/CMP/CKIM
Serial No.: 09/645,690

Small et al. in view of *Prigge et al.*, *Scrovan*, *Talieh et al.*, *Kennedy et al.*, and *Sirchevski et al.*, alone or in combination, does not teach, show, suggest or motivate a method of cleaning a surface of a polishing pad, which includes conducting chemical-mechanical polishing (CMP) on a first wafer on the surface of the polishing pad, removing the first wafer from the polishing pad, applying to the polishing pad surface a cleaning composition, and cleaning the polishing pad surface with the cleaning composition, wherein the cleaning composition includes about 0.1 to about 3.0 wt.% of ethylenediamine, an acid selected from the group consisting of phosphoric acid, acetic acid and sulfuric acid or a base selected from the group consisting of potassium hydroxide, sodium hydroxide and ammonium hydroxide in an amount such that the composition has a pH of about 5.0 to about 12.0, and deionized water, as recited in claim 26 and claims dependent thereon.

In conclusion, the references cited by the Examiner, alone or in combination, do not teach, show, or suggest the invention as claimed.

Having addressed all issues set out in the office action, Applicant respectfully submits that the claims are in condition for allowance and respectfully request that the claims be allowed.

Respectfully submitted,



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